

WHAT IS CLAIMED IS

5

1. A magnetic recording medium

comprising:

at least one exchange layer structure, and

a magnetic layer formed on said exchange layer

10 structure,

said exchange layer structure comprising:

a ferromagnetic layer; and

a non-magnetic coupling layer provided on
said ferromagnetic layer and under said magnetic

15 layer,

said ferromagnetic layer and said magnetic
layer having antiparallel magnetizations.

20

2. The magnetic recording medium as

claimed in claim 1, wherein said ferromagnetic layer
is made of a material selected from a group

25 consisting of Co, Ni, Fe, Ni-based alloys, Fe-based
alloys, and Co-based alloys including CoCrTa, CoCrPt
and CoCrPt-M, where M = B, Mo, Nb, Ta, W or alloys
thereof.

30

3. The magnetic recording medium as

claimed in claim 1, wherein said ferromagnetic layer

35 has a thickness in a range of 2 to 10 nm.

09425788-102299

sub
A1

sub A2

4. The magnetic recording medium as claimed in claim 1, wherein said ~~non-magnetic coupling layer is made of a material selected from a group of Ru, Rh, Ir, Ru-based alloys, Rh-based~~
5 alloys, and Ir-based alloys.

10

5. The magnetic recording medium as claimed in claim 1, wherein said non-magnetic coupling layer has a thickness in a range of 0.4 to 0.9 nm.

15

sub A3

6. The magnetic recording medium as claimed in claim 1, wherein ~~said magnetic layer is made of a material selected from a group of Co, and Co-based alloys including CoCrTa, CoCrPt and CoCrPt-M, where M = B, Mo, Nb, Ta, W or alloys thereof.~~

25

7. The magnetic recording medium as claimed in claim 1, which further comprises:
a substrate; and
30 an underlayer provided above said substrate, said exchange layer structure being provided above said underlayer.

35

sub A4

~~8. The magnetic recording medium as~~

09435788 102299 662207 88/52460

claimed in claim 7, which further comprises:

a non-magnetic intermediate layer interposed between said underlayer and said exchange layer structure,

5 said non-magnetic intermediate layer having a hcp structure alloy selected from a group of CoCr-M, where M = B, Mo, Nb, Ta, W or alloys thereof, and having a thickness in a range of 1 to 5 nm.

10

9. The magnetic recording medium as claimed in claim 8, which further comprises:

15 a NiP layer interposed between said substrate and said underlayer, said NiP layer being mechanically textured or oxidized.

20

Sub AS 10. The magnetic recording medium as claimed in claim 7, wherein said underlayer is made of a B2 structure alloy selected from a group of
25 NiAl and FeAl.

30

11. The magnetic recording medium as claimed in claim 1, which comprises at least a first exchange layer structure and a second exchange layer structure interposed between said first exchange layer structure and said magnetic layer, wherein a
35 ferromagnetic layer of said second exchange layer structure has a magnetic anisotropy lower than that of a ferromagnetic layer of said first exchange

09425788-102299

layer structure, and magnetizations of the ferromagnetic layers of said first and second exchange layer structures are antiparallel.

5

12. The magnetic recording medium as claimed in claim 1, which comprises at least a first exchange layer structure and a second exchange layer structure interposed between said first exchange layer structure and said magnetic layer, wherein a product of a remanent magnetization and thickness of a ferromagnetic layer of said second exchange layer structure is smaller than that of a ferromagnetic layer of said first exchange layer structure, and magnetizations of the ferromagnetic layers of said first and second exchange layer structures are antiparallel.

20

13. A magnetic storage apparatus comprising:
at least one magnetic recording medium including at least one exchange layer structure, and a magnetic layer formed on said exchange layer structure; and
at least one head recording information on and/or reproducing information from the recording medium,
said exchange layer structure comprising:
a ferromagnetic layer; and
a non-magnetic coupling layer provided on said ferromagnetic layer and under said magnetic layer,

09425788-102299

said ferromagnetic layer and said magnetic layer having antiparallel magnetizations.

5

14. The magnetic storage apparatus as claimed in claim 13, wherein said ferromagnetic layer is made of a material selected from a group consisting of Co, Ni, Fe, Ni-based alloys, Fe-based alloys, and Co-based alloys including CoCrTa, CoCrPt and CoCrPt-M, where M = B, Mo, Nb, Ta, W or alloys thereof.

15

15. The magnetic storage apparatus as claimed in claim 13, wherein said ferromagnetic layer has a thickness in a range of 2 to 10 nm.

20

16. The magnetic storage apparatus as claimed in claim 13, wherein said non-magnetic coupling layer is made of a material selected from a group of Ru, Rh, Ir, Ru-based alloys, Rh-based alloys, and Ir-based alloys.

25

17. The magnetic storage apparatus as claimed in claim 13, wherein said non-magnetic coupling layer has a thickness in a range of 0.4 to 0.9 nm.

30

35

09425788-10299

18. The magnetic storage apparatus as claimed in claim 13, wherein ~~said magnetic layer is made of a material selected from a group of Co, and Co-based alloys including CoCrTa, CoCrPt and CoCrPt-~~
5 M, where M = B, Mo, Nb, Ta, W or alloys thereof.

10

15

20

25

30

35

09425788-102299